

REMARKS

This application has been reviewed in light of the Office Action dated June 16, 2005. Claims 1, 3-9, and 21-27 are pending in the application. Claim 2 has been cancelled without prejudice. Claims 1, 21, 22 and 23 have been amended. No new matter has been introduced. The Examiner's reconsideration of the rejection in view of the amendment and the following remarks is respectfully requested.

By the Office Action, claims 1, 3, 5, 8 and 22 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Application Publication No. 2005/0101130 A1 to Lopatin et al. (hereinafter Lopatin). The Applicant respectfully disagrees with the rejection.

Lopatin is directed to a method for creating a barrier layer which includes traces of Re, but fails to disclose or suggest a pure metal or crystalline form of Re. Instead, Re is disbursed with other materials in the barrier layer as indicated in Paragraph [10]. In addition, the specification and claims disclose an atomic percent of about 1% or claimed between .1 % and 14%. The Re is deposited along with many other components and produces a layer with atomic Re interspersed with other elements. The deposition process disclosed includes multiple elemental sources and compounds which results in a layer having multiple elements with only traces of Re. There is no metallic crystalline form of Re disclosed or suggested, let alone a thermally stable hexagonal close packed layer of Re. Nowhere in Lopatin is a barrier layer disclosed or suggested which includes a hexagonally close packed metal form of Ru or Re.

Claims 1 and 22 have been amended to recite, *inter alia*, the barrier layer includes a thermodynamically stable hexagonal close packed metal crystalline form of (at least one of Ru and) Re. The present invention provides a barrier layer that exhibits improved performance and

does not suffer from the severe resistivity increases and different metastable phases of metals, such as beta-W for Tungsten) which form due to temperature changes (See Background page 3). Films including beta-W are no longer useful diffusion barriers. The present invention solves these problems and provides a hexagonal close packed form of Re and/or Ru which is stable and conductive in its metallic state. While Lopatin includes Re as a diffusion barrier component, Lopatin fails to disclose or suggest at least that the barrier layer includes a thermodynamically stable hexagonal close packed metal crystalline form of (at least one of Ru and) Re.

Claims 1 and 22 are believed to be allowable for at least the stated reasons.

Reconsideration of the rejection is respectfully requested.

By the Office Action, claims 1, 5, 8 and 21 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent Application Publication No. 2005/0095855 A1 to D'urso et al. (hereinafter Durso). The Applicant respectfully disagrees with the rejection.

Durso mentions the use of Ru in a barrier layer but is silent as to its form. It is noted that the interspersing of atoms on or in a layer is completely different from the formation of a metallic close packed crystalline metal layer. Durso discloses the mere presence of Ru in a layer but fails to disclose or suggest the process or details in which it is formed thereby relying on the prior art techniques which fail to disclose or suggest a barrier layer which includes a thermodynamically stable hexagonal close packed metal crystalline form of Ru, as essentially set forth in claims 1 and 21.

Both Durso and Lopatin call for a barrier material which includes interspersed atoms of Re or Ru (note that neither reference refers to both Re and Ru). There is no teaching or suggestion that a crystalline form of these metals be used, or that a hexagonally close packed crystalline form is provided. In addition, there is no disclosure or suggestion of a

thermodynamically stable form of the metal be formed. For example, the crystalline form in accordance with the present invention remains intact and does not transition into a different crystal phase during selected temperature changes. The advantages and benefits of the present invention are not contemplated by the cited references Lopatin and Durso. It is therefore apparent that the teaching of the present invention are not disclosed or suggested by either Lopatin or Durso. Consequently, the present claims should be allowed for at least the reasons stated.

By the Office Action, claims 6, 7 and 9 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Lopatin and alternately as being unpatentable over Durso.

The Applicant respectfully disagrees with the rejection due at least to the dependencies of claims 6, 7 and 9 from base claims believed to be in condition for allowance. Reconsideration is respectfully requested.

Claims 6 and 7 describe a temperature range over which the barrier layer is thermodynamically stable. This feature is not disclosed or suggested by either Lopatin and/or Durso for a thermodynamically stable hexagonal close packed metal crystalline form Re or Ru (respectively). Therefore, these claims are believed to be allowable for at least these reasons as well.

By the Office Action, claims 2, and 23-27 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Lopatin in view of U.S. Patent Application Publication No. 2002/0197856A1 to Matsuse et al. (hereinafter Matsuse).

Matsuse describes a method of forming a barrier layer and includes Ru in a nitride form. RuN_x is a not a metal form of Ru. Matsuse fails to disclose or suggest the use of a metal

form of at least one of Ru and Re as a barrier layer. Matsuse fails to disclose or suggest a thermodynamically stable hexagonal close packed metal crystalline form Ru.

The Examiner stated that the metal 16 in FIG. 1 of Matsuse includes a hexagonal close packed structure. The Applicant respectfully disagrees. First, there is no teaching that the metal 16 of Matsuse is hexagonal close packed, and second even if metal 16 were hexagonal close packed, metal 16 is not a barrier layer as disclosed in the present claims. Since Matsuse fails to disclose or suggest at least a barrier layer that includes a thermodynamically stable hexagonal close packed metal crystalline form of at least one of Ru and Re, Matsuse fails to cure the deficiencies of Lopatin.

Therefore, claims 2, and 23-27 are believed to be in condition for allowance over the cited art for at least the reasons stated.

By the Office Action, claims 2, 23, 24, 26 and 27 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Durso in view of Matsuse.

As stated above, Matsuse describes a barrier layer that includes Ru in a nitride form. Matsuse fails to disclose or suggest the use of a metal form of at least one of Ru and Re as a barrier layer. Matsuse fails to disclose or suggest a thermodynamically stable hexagonal close packed metal crystalline form Ru.

As described above, nowhere in Matsuse is a hexagonal close packed structure disclosed or suggested for a barrier layer or for any metal described therein. There is no teaching or suggestion that the metal 16 of Matsuse is hexagonal close packed, and even if metal 16 were a hexagonal close packed metal, metal 16 is not a barrier layer as disclosed in the present claims. Since Matsuse fails to disclose or suggest at least a barrier layer that includes a

thermodynamically stable hexagonal close packed metal crystalline form of at least one of Ru and Re, Matsuse fails to cure the deficiencies of Durso.

Therefore, claims 2, 23, 24, 26 and 27 are believed to be in condition for allowance over the cited art for at least the reasons stated.

In view of the foregoing amendments and remarks, it is respectfully submitted that all the claims now pending in the application are in condition for allowance. Early and favorable reconsideration of the case is respectfully requested.

It is believed that no additional fees or charges are currently due. However, in the event that any additional fees or charges are required at this time in connection with the application, they may be charged to applicant's IBM Deposit Account No. 50-0510.

Respectfully submitted,

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